



* Why scientists classify elements: To easy study the elements

Mendeleev's periodic table: first table to classify elements
He arranged (67) in ascending order according to their atomic weights
Group: vertical columns   Period: horizontal rows
-He classify elements into A and B groups. (due to difference between their properties)

Advantages of Mendeleev's periodic table:
1- He left gaps for discover new elements.
2- He corrected wrong atomic weights of some elements.

Disadvantages of Mendeleev's periodic table:
1- He arrange elements in wrong way (to put them in groups suitable to their properties)
2- He put more than one element in one place. (due to similar in their properties)

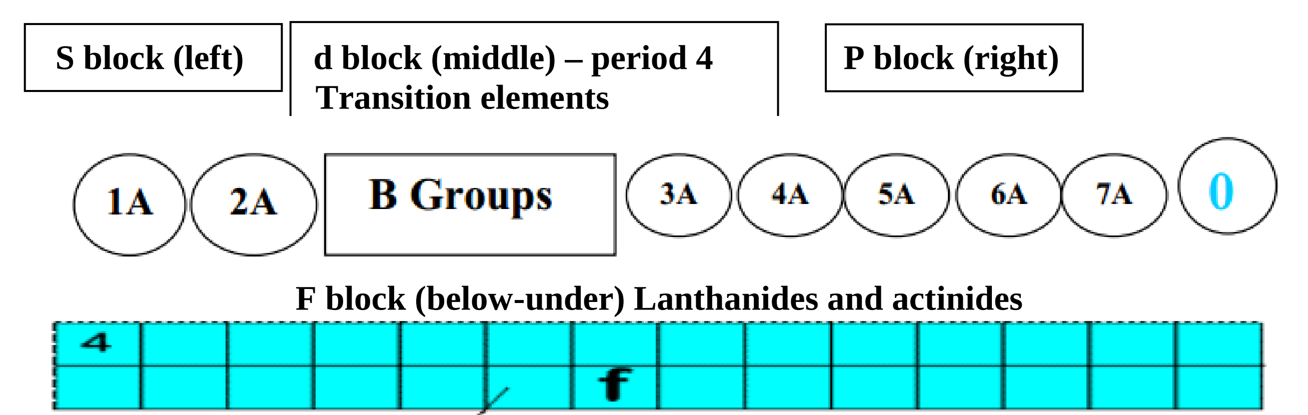
Rutherford: discover the nucleus has positive protons.

Moseley's periodic table:
1- He arranged elements ascending according to atomic numbers.
2- He added zero group which includes inert (noble) gases.
3- He specified a place below the table for lanthanides and actinides elements.

Bohr: discovered the main 7 energy levels of the atom.

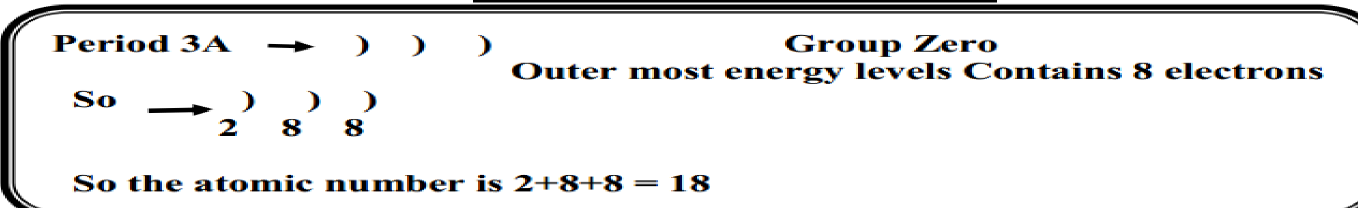
Modern periodic table: no. of elements = 116
- Elements are classified in the Modern periodic table according to:
  Atomic number and filling energy levels by electrons.

Consists of (7) horizontal periods and (18) vertical groups



To locate position of element in modern periodic table:
-The period number = no. of energy levels
-The group number = no. of electrons in outer level

How to determine the atomic number:



The new number of zero (0) group is 18.
The new number of group (5A) is 15.

Lesson (2): Graduation of the properties of elements in the Modern periodic table



Atomic size: its measuring unit is picometre.

Electronegativity: It's ability of atom in covalent molecule to attract electrons of the bond towards.

The inert gases haven't Electronegativity: because they don't enter in chemical reaction.

Polar compounds:
They are covalent compounds which difference in electronegativity between elements is high.
Ex: * water (H_2O) * Ammonia (NH_3)

Metalloids: They are elements which have the properties of both metals and nonmetals.
Ex. Silicon - Boron

	In period	In group
Atomic size	Decreases. Due to increase attraction between +ve nucleus and electrons Cesium Cs is largest atomic size	Increases. Due to increase no.of energy levels Fluorine F is smallest atomic size
Metallic properties	Decreases. Cesium Cs is strongest metal in 1A	Increases. Due to increase the atomic size Lithium Li is lowest metallic in 1A
Non-metallic property	Increases.	Decreases.

Chemical activity series:
It's a series in which metals are arranged in a descending order according to their chemical activity
K – Na react instantly – Ca – Mg react slowly with water
Zn – Fe react with hot water Cu – Ag don't react with water

	Metals	Nonmetals
Elements which have	less than (4) electrons in outer level	more than (4) electrons
Chemical reaction	Positive ion	Negative ion
Atomic size	Largest	Smallest
Reaction with hydrochloric acid	$Mg + 2HCl \longrightarrow MgCl_2 + H_2$ Pop sound	Don't react
Reaction with oxygen	$2Mg + O_2 \longrightarrow 2MgO$ Forming basic oxide $MgO + H_2O \longrightarrow Mg(OH)_2$ (Magnesium hydroxide) - blue	$C + O_2 \longrightarrow CO_2$ Forming acidic oxide $CO_2 + H_2O \longrightarrow H_2CO_3$ (Carbonic acid) - red

Basic oxides	Acidic oxides
They are metal oxides	They are nonmetal oxides
Some of them dissolve in water giving alkalis	They dissolve in water giving acids
Their solutions (alkalis) turns litmus solution into blue.	Their solutions turns litmus solution into red.
Ex.: Na_2O – MgO	Ex.: CO_2 – SO_2



Lesson (3): Main Groups in M. P. T.

1- Group (1A): Alkali metals.
2- Group (17) or (7A): Halogens.
3- Group (18) or (Zero group) : Inert gases.

* **Group (1) or (1A): Alkali metals**: They're located on max. left side of M.P.T. first group of s-block.

Physical properties:

1- Solids – have metallic luster - Good conductors of heat and electricity.
2- Most have low density:

(Li), (Na) and (K)	Float on water G.R:: As their densities are smaller than water density.
(Rb) and (Cs)	Sink in water.
	(Li is lowest density) - (Cs is highest density) in alkali metal

Chemical properties:

1- They have one electron in outer energy level
2- Monovalent elements: As they lose one electron in outer level forming +ve ion.
3- Active elements so, they're kept under the surface of kerosene or paraffin oil.
G.R: (Na) - (K) kept under kerosene surface To prevent them from reaction with moist air
(Li) kept under the surface of paraffin
4- Their chemical activity increases as the atomic size increases: therefore
G.R: (Cs) is the most active metal: Bec. It has the largest atomic size.

Element of group (1A) called Alkali metals: As they react with water forming alkaline solutions.

$2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$ $2K + 2H_2O \longrightarrow 2KOH + H_2\uparrow$

Reaction of K is stronger than Na : As K more active and large atomic size than Na

Sodium fires is not put off with water
Bec. it reacts fast with water produce H_2 gas which burns with a pop sound.

* **Group (17) or (7A): Halogens**: They're located on right side of M.P.T., they're elements of p-block.

Physical properties:

1- Bad conductors of heat and electricity.
2- Fluorine, Chlorine (Gas) – Bromine (liquid) – Iodine (solid)

Chemical properties:

1- Outermost energy levels have (7) electrons
2- Monovalent elements : As gain one electron forming negative ion.
3- Exist in the form of diatomic molecules (2 atoms): (F_2), (Cl_2), (Br_2) and (I_2).
4- Active elements so they don't exist individually in nature
5- Called halogens: G.r: Bec They reacts with metals forming salts.

$2Na + Cl_2 \longrightarrow 2NaCl$ $2K + Br_2 \longrightarrow 2KBr$ potassium bromide.

6- Each element replaces the element below it in its salt solution.

$Cl_2 + 2\,KBr \rightarrow 2\,KCl + Br_2$
chlorine potassium bromide potassium chloride bromine

$Cl_2 + 2\,NaBr \rightarrow 2\,NaCl + Br_2$
chlorine sodium bromide sodium chloride bromine

$Br_2 + 2KI \rightarrow 2\,KBr + I_2$
Potassium iodide



* **Group (18) or (0): Inert gases : They're located on max. right side of M.P.T, the last group in p-block.**
* **Properties of inert gases :**
  1- They are gaseous state
  2- Outer energy level have 8 electrons except Helium has 2 electrons in K level
  3- Valency = Zero Bec. outer level is completely filled with electrons
  4- Chemically inactive
  5- Monoatomic (one atom)

1- Sodium (Na):
- Used in liquid state to transfer heat from inside to outside of the nuclear reactor.
- This heat is used to obtain the vapor energy to generate electricity.

2- Cobalt (Co): Radioactive cobalt 60.
Used in food preservation. Bec. it emits gamma rays which prevent reproduction of microbes

3- Silicon (Si): metalloid.
Used in the manufacture of electronic devices as computer. G.r: Bec. Its semi-conductor

4- Liquefied nitrogen: Non-metal.
Used in preservation of cornea of eye. G.r: due to the decrease of its boiling point (-196°).

Lesson (4): Water



* **Structure of water molecule:**

- Combination of one oxygen atom with two hydrogen atoms by 2 single covalent bonds, angle is 104.5°.
- Water molecules linked together by hydrogen bonds G.r:
  Bec. oxygen has higher electronegativity than hydrogen
- Hydrogen bond: it's a weak electrostatic attraction between the molecules of polar compounds.
- Hydrogen bond is weaker than covalent bond and it's responsible for abnormal properties of water.

A- **Physical properties:**

1- Water has 3 states (solid – liquid – gas)

2- Water is good polar solvent:
- Dissolve most ionic compounds as table salt (sodium chloride).
- Dissolve some covalent compounds as sugar: G.r: As it form hydrogen bonds with water.
- Can't dissolve oil: G.r: As they can't form hydrogen bonds with water

3- Rising of water boiling and freezing point : Pure water boils at 100°C and freezes at 0°C: G.r:
Due to presence of hydrogen bonds between its molecules.

4- Water density decreases on freezing: Bec. ice has large volume than water
High density of water at 4°C - Low density of water at 0°C

- G.R Aquatic creatures still alive in polar ocean. Bec. ice has large volume float on water.

B- **Chemical properties:**

1- Water has a neutral effect on litmus paper: it doesn't affect on litmus paper.

2- Water electrolysis:

- Hofmann's voltameter: used for the electrolysis of acidified water.

- Oxygen: evolves at Anode: makes more glowing.
- Hydrogen: at Cathode: making pop sound.
- The volume of hydrogen gas is twice of oxygen (ratio is 2:1).
  Volume of hydrogen = 2 x volume of oxygen $V \text{ of } O_2 = V \text{ of } H_2 /2$

$$- 2H_2O \xrightarrow{\text{Electrolysis}} 2H_2 + O_2$$

- G.R: Adding drops of dilute sulphuric acid to water during elec.:
  to make water conduct electricity as pure water is a bad conductor of electricity.

* **Water pollution**: Addition of substance to water causes change in water properties affecting life.

1- Natural pollutants: volcanic eruption – death of living organisms – lightning
2- Artificial pollutants: insecticides – burning of coal and oil

pollution	Causes	Harms
Biological	Mix man-animal wastes with water	Bilharzias - typhoid – hepatitis
Chemical	Factories wastes in water	- lead: causes death of brain cells. - Mercury: make blindness. - Arsenic: liver cancer.
Thermal	Rise temp. of water	Death of marine creatures due to separation of oxygen in water
Radiant	- atomic wastes radioactive in water	

- **Protection of water from pollution:**
  1- Preventing wastes and dead animals in water.
  2- Disinfection of water tanks
  3- Don't store tap water in plastic bottles: as plastic reacts with chlorine make cancer.
  4- Make stations of water purification.

Lesson(2): Erosion of Ozone layer and Global warming



Ozone layer: composed of ozone gas O_3

O_2 —UV→ O + O (Atoms) O_2 + O ⟶ O_3

Formation of ozone layer in stratosphere layer (20km - 40km)
Bec. it has oxygen gas faces UV rays

Thickness of ozone layer:
- Dobson: measuring unit of the degree for ozone layer.
- The normal degree of ozone is 300 Dobson.   STP = standard temp. and pressure

3 types of (UV)

1- Near UV: penetrate ozone layer by 100%. Useful
2- Medium UV: don't penetrate (absorbed) from ozone layer by 95% harm
3- Far UV: don't penetrate (absorbed) from ozone layer by 100% harm

* Ozone layer acts as a protective shield for living organisms
  Bec. it absorbs harm far and medium UV rays

Erosion of Ozone layer: Scientists see erosion of ozone layer at South Pole (Ozone hole).
- Ozone hole: Thinning or losing parts of ozone layer above the South Pole.

Ozone hole increases in September each year.

- **Pollutants of ozone layer**:
  1- Chlorofluorocarbon compounds (CFC_s): known as *Freon*: is used as:
  - Cooling.   - Aerosols. الاسبراى   - Cleaning.

  2- Methyl bromide gas: used as insecticide to keep stored crops.
  3- Halons: used in fire extinguishers.
  4- Nitrogen oxides: produced from the burning of fuel of Concorde plane.

Global Warming phenomenon: continuous increase in the average temp. of the Earth.

Global warming is caused by the greenhouse effect.
Greenhouse effect: It's the trapping of infrared radiation in the troposphere layer .
Greenhouse gases:
1- CO_2 gas   2- CFC_s 3- Methane gas   4- Nitrous oxide   5- Water vapour

The reasons of increasing greenhouse gases:
1- Fuel burning.   2- Cutting trees.   3- Forests fires.

G.R occurrence of greenhouse effect:
Due to trapped of infrared radiation by greenhouse gases.

Note: ultraviolet radiation has chemical effect --- Infrared radiation has thermal effect

The negative effects of global warming phenomenon:
1- Melting of ice of two poles: leads to increase sea level cause:
  - Coastal areas drown. غرق المناطق الساحلية - Extinction of polar bear

2- Severe climatic changes:
  - Hurricanes. اعصار - Floods. فيضان Drought. جفاف - Forests fires.



Unit: (3): Lesson(1): Fossils

Fossils: Traces and remains of old living organisms preserved in sedimentary rocks.
Trace : Traces of old living organism indicate its activity during its life.
Examples of traces: Worms' tunnels – Dinosaur's foot print.

Remains: Traces indicate remains of old living organism after death.
Examples of remains: Remains of shark's teeth – Remains of a dinosaur's skull.

Types of fossils

1- **Complete body fossils**: fossil keeps whole shape and details of body of organism
Examples:
A- **Mammoth**: It died and buried in snow.
B- **Amber**: It's the solidified resinous matter which was secreted by pine trees

2- **Mold fossil**: It's the replica of internal details of structure of old living organism.
Examples: Ammonites fossil – Nummulites fossil – Trilobite fossil.

3- **Cast fossil**: It's the replica of external details of structure of old living organism.
- Examples: ferns cast – Fish cast.

متحجرة
4- **Petrified fossils**: fossils which minerals replace organic matter of organism
Examples: Dinosaur's tooth - Dinosaur's eggs – Petrified wood.

Petrification: It's the process which minerals replace organic matter of organism
Petrified wood: fossils which silica replace wood matter of trees..
GR: Qattamiya is called wood mountain Bec. it has petrified woods like rocks.

Suitable conditions for fossils formation:
1- Hard skeleton. 2- Burying dead organism fast . 3- Suitable medium.

* **Importance of fossils:**
1- **Age determination of sedimentary rocks.**
Index fossil: حفرية مرشدة
Fossils of organisms lived for a short time in the past and wide spread, then became extinct.

2- **Give idea about environment**: التعرف ع البيئة القديمة
Examples:
1- Nummulites fossil: found in limestone rocks and indicate that Mokattam was a sea floor.
2- Ferns fossils: indicate the environment was a hot and rainy tropical.
3- Coral fossils: indicate the environment was clear warm shallow seas.

3- **Studying life evolution**: دراسة تطور الحياة
- **Fossil record**: السجل الحفرى
Sequence of fossils in sedimentary rocks according to sequence of appearance.

- **Archaeopteryx** fossil is a link between reptiles and birds.
Example: Trilobite (sea Invertebrates) – Fish – Archaeopteryx – Mammoth.

4- **Petroleum exploration**:
- Scientists take samples from rocks and study them under microscope.
- If they contain microfossils like: Foraminifera and radiolaria, point to:
- Age of rocks.
- Suitable conditions for petroleum formation.



Extinction: الانقراض

- It's continuous decrease without compensation in no. of species of organisms till all members die out. Or: It's dying out of all members of species of living organism.
- Fossil record indicates extinction

Reasons of old extinction:

1- Meteorite impacts Earth.
2- Long glacial age. عصر جليدى طويل
3- Poisonous gases from volcanoes.

Reasons of recent extinction: due to man interference

1- Destroying natural habitat تدمير الموطن الطبيعى
2- Overhunting الصيد الجائر
3- Environmental pollution التلوث البيئى
4- Climatic changes and Natural disasters تغيرات مناخية – كوارث طبيعية

The extinct species انواع انقرضت

Dinosaur – Mammoth - Dodo bird – Quagga

* Dodo bird is non-flying bird GR due to have small wings easy to hunt.
* Quagga: mammal animal midway between horse & zebra .

*** The endangered species** انواع معرضة للانقراض

* Panda bear
* Rhinoceros
* Bald eagle: Bec. its head covered with white feathers like bald.
* Ibis bird
* Papyrus plant: used by pharaohs to make writing papers.
* Barbary sheep

Food chain: It's the path of energy transfer from a living organism to another in the ecosystem.

Food web: It's a group of food chains connected with each other.

What happen: Extinction of species in balanced ecosystem? It destroy ecosystem balance.

Types of Ecosystem

1- Simple ecosystem: has a few number of members, absence of one of its members affect its balance Bec. absence of alternative that replace it As: Desert.
2- Complicated ecosystem: has multiple members , not affected by absence of one of its species Because it has many alternatives, As: Tropical forest.

Ways to protect living from extinction:

1- Make rules to control hunting.
2- Send endangered species to their habitats.
3- Make gene banks.
4- Make natural protectorates.

Natural protectorates: They're safe areas Established to protect endangered species in their homeland.

Important world's protectorates:

1- Bluestone: U.S.A – Grey bear
2- Panda: China - Panda bear
3- Ras Mohamed: first protectorate in Egypt – Coral reefs – colored fish
4- Wadi El-Hetan: Complete whales skeletons fossils.

P.O.C	Troposphere	Stratosphere	Mesosphere	Thermosphere
	- The first layer - It means the disturbed layer. GR bec. all weather changes happen in	- The second layer. - It is called the ozonic atmospheric envelope. GR because it has most of ozone gas.	- The third layer. - The middle layer - The coldest layer.	- The fourth layer. - It is called thermal layer .GR bec. it is the hottest layer of atmosphere
Thickness	13 km.	37 km.	35 km.	590 km.
Temperature	Decreases at a rate (6.5°C) for each 1 km height - (-60°C) at its top.	-Increases to (0°C) at its top. GR> bec. it has ozone layer that absorbs ultraviolet rays	- It is the coldest layer GR because temp. decreases at high rate (-90°C)	- Increases with high rate 1200°C
importance	- All atmospheric phenomena take place in.GR bec. it contains 75% of mass of air. - It organizes the Earth's temp.. Bec. it has 99% of water vapour.	- It contains most of ozone gas so it is called ozonic atmospheric envelope.	- It is much vacuumed GR bec. it has helium and hydrogen gases only. - It protect Earth from rocks due to it burns by friction with air molecules.	- Its upper part called <u>ionosphere</u> Bec. it has charged ions GR ionosphere important in wireless communication Bec. it reflects radio waves
Air movement	- vertical Temp. up =Temp. d – (Hx6.5) Temp. d = Temp. up + (Hx6.5) H = Temp. d - Temp. up / 6.5	- horizontal - Pilots prefer to fly in stratosphere. GR> Bec. don't have clouds or weather disturbances and air moves horizontal.		Ionosphere surrounded by <u>Van-Allen belts</u> Scatter harm cosmic rays away from Earth <u>Aurora phenomena</u> Bright light curtains at 2 poles

<u>Exosphere</u>: region which atmosphere inserted in outer space. <u>Importance:</u> satellites transmit TV programs and weather information.

<u>Atmospheric envelope:</u> gaseous envelope rotates with earth around its axis and extends to 1000km above sea level.

Atmospheric pressure: It's the weight of air column of atmospheric height on a unit area ($1m^2$). - Atmospheric pressure unit: bar – millibar.

Normal Atmospheric pressure: It's the atmospheric pressure at sea level and it equals 1013.25 mb.

GR atmospheric pressure increases under sea level
Due to increase length and weight of air column

GR atmospheric pressure decreases above sea level
Due to decrease length and weight of air column

* The instruments of measuring the Atmospheric pressure: barometers

1- Aneroid: determines the possible day weather

2- Altimeter: measure the elevation from sea level.

* Isobar: It's the curved lines that join the points of equal pressure in atmospheric pressure maps.

<u>Tropopause</u> region between troposphere and stratosphere

<u>Stratopause</u> region between stratosphere and mesosphere

<u>Mesopause</u> region between mesosphere and thermosphere